



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF PREVENTION, PESTICIDES AND TOXIC SUBSTANCES

January 9, 2006

MEMORANDUM

SUBJECT: Updated Review of Rodenticide Incident Reports Primarily Concerning Children, DP Barcode D332563, Chemical#112701, 112001, 128967, 086002, 067707, 067701, 088601, 802901,112802

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RODENTICIDE REVIEW

This review addresses the incidents of a group of the following nine rodenticides:

- 1- Brodifacoum (PC Code 112701),
- 2- Bromadiolone (PC Code 112001),
- 3- Difethialone (PC Code 128967),
- 4- Warfarin (PC Code 086002),
- 5- Chlorophacinone (PC Code 067707),
- 6- Diphacinone (PC Code 067701),
- 7- Zinc Phosphide (PC Code 088601),
- 8- Cholecalciferol (PC Code 802901), and

9- Bromethalin (PC Code 112802).

The purpose of this review is to update poisoning incident data received since completion of 1999 incident review by Dr. Blondell¹. The Poison Control Center (PCC) data includes rodenticides that are not currently under evaluation by EPA. A summary of the various rodenticides in each analysis time period is given in Attachment 1.

The report is divided in two sections: (i) cases reported in the Incident Data System from 1999 to the present; and (ii) cases reported in the Poison Control Center Database from 1999 to 2003. For this later database, SRRD indicated that cases involving young children (6 years old or less) were the primary interest and the database search was limited to cases meeting this criterion.

1. Incident Data System

1) OPP Incident Data System (IDS) - reports of incidents from various sources, including registrants, other federal and state health and environmental agencies and individual consumers, submitted to OPP since 1992. Reports submitted to the Incident Data System represent anecdotal reports or allegations only, unless otherwise stated. Typically no conclusions can be drawn implicating the pesticide as a cause of any of the reported health effects. Nevertheless, sometimes with enough cases and/or documentation risk mitigation measures may be suggested.

According to the Incident Data System, it appears that the majority of cases in children occurred from exposure to Brodifacoum (30 cases out of 43 or 68%) and the most common symptoms reported were diarrhea, vomiting, and skin rash. Specifics relating to these incidents are detailed and fully described in Attachment 2, where they are identified by Incident Number and sorted by rodenticide name.

2. Poison Control Center Data - 1999 through 2003 for a combination of 9-Rodenticides

This section discusses results from the Poison Control Center's Toxic Exposure Surveillance System (TESS) from the years 1999 through 2003 and reflects only data collected for children six years of age or less. Cases involving exposures to multiple products and cases with unrelated medical outcome are excluded. The tables included in this section transmit acute pesticide poisoning incidence resulting from exposure to the following 9 rodenticides:

- 1- Brodifacoum (PC Code 112701),
- 2- Bromadiolone (PC Code 112001),
- 3- Difethialone (PC Code 128967),
- 4- Warfarin (PC Code 086002),
- 5- Chlorophacinone (PC Code 067707),
- 6- Diphacinone (PC Code 067701),
- 7- Zinc Phosphide (PC Code 088601),

¹ The chemicals of regulatory interest that comprise this "Rodenticide Group" have changed over time and differ somewhat between the 1999 incident review by J. Blondell and this "updated" incident review.

- 8- Cholecalciferol (PC Code 802901), and
9- Bromethalin (PC Code 112802)

Table 1 below compares the frequency of poisoning incidents among all 9 rodenticides in the EPA group with the composite of all pesticides for which the PCC received an incident report. The frequency of events is reported by health effect severity category (all symptoms, moderate, and major) and by level of health care received. This ratio provides a simple measure of the relative frequency of reported health effects by severity category. Knowledge of the ratios of symptoms for a class of chemical (or a single chemical) provides a relative measure of the public health impact of the acute pesticide events. In addition, a Likelihood Ratio test shows whether the compounds under study are significantly different from the average of all other pesticides. An **(S)** indicates the proportions are significantly different.

For a more detailed explanation of Table 1 see Attachment 3.

Table 1. Relative Frequency of Acute Poisoning Incidents by Symptom Severity: Non-Occupational Cases Involving Children Six Years of Age or Less.

	Severity of outcome (outcome determined)			Total exposed	Health care provided	
Denominator numbers	25,549			68,005	18,084	
Measures	SYM¹	MOD²	MAJ³	HCF⁴	HOSP⁵	ICU⁶
Numerator numbers	578	83	9	18,084	302	219
9 Rodenticides percents	2.26%	0.32%	0.03%	26.59%	1.67%	1.21%
All Pesticides percents	21.72%	1.42%	0.12%	15.68%	4.34%	1.75%
Ratio of 9 Rodenticides /All pesticides	0.10(S) P=0.00	0.23 (S) P = 0.00	0.25 P = 0.94*	1.69 (S) P = 0.00	0.38 (S) P = 0.00	0.69 P =0.51

*Proportions and sample size too small for a valid significance test.

- 1) percent with ANY symptom in relation to the total of cases followed,
- 2) percent with moderate symptoms in relation to the total of cases followed,
- 3) percent with major or fatal outcome in relation to the total of cases followed,
- 4) percent of case seen in a Health Care Facility (HCF) in relation to total exposures
- 5) percent of cases seen in a Hospital in relation to cases seen in a HCF
- 6) percent of cases taken to an Intensive Care Unit (ICU) in relation to cases seen in a HCF.

Analysis of Results

The ratio of children seen at a HCF is higher than the proportion seen among all pesticides exposure – approximately 27% v. 16%. This may be due to increased concern for children's

safety; difficulty in determining exposure in children (cannot communicate exposure experience) and therefore require additional testing; knowledge or fear concerning rodenticides; or other unknown factors. Importantly, the proportion of children admitted to hospital or ICU is less than or equal to that seen among the ALL pesticide composite. This suggests that while visits to HCF is high, effects seen are treatable and do not require hospitalization. However for severity of outcome, (SYM, MOD, and MAJ) rodenticide incidents are significantly lower compared to all pesticides.

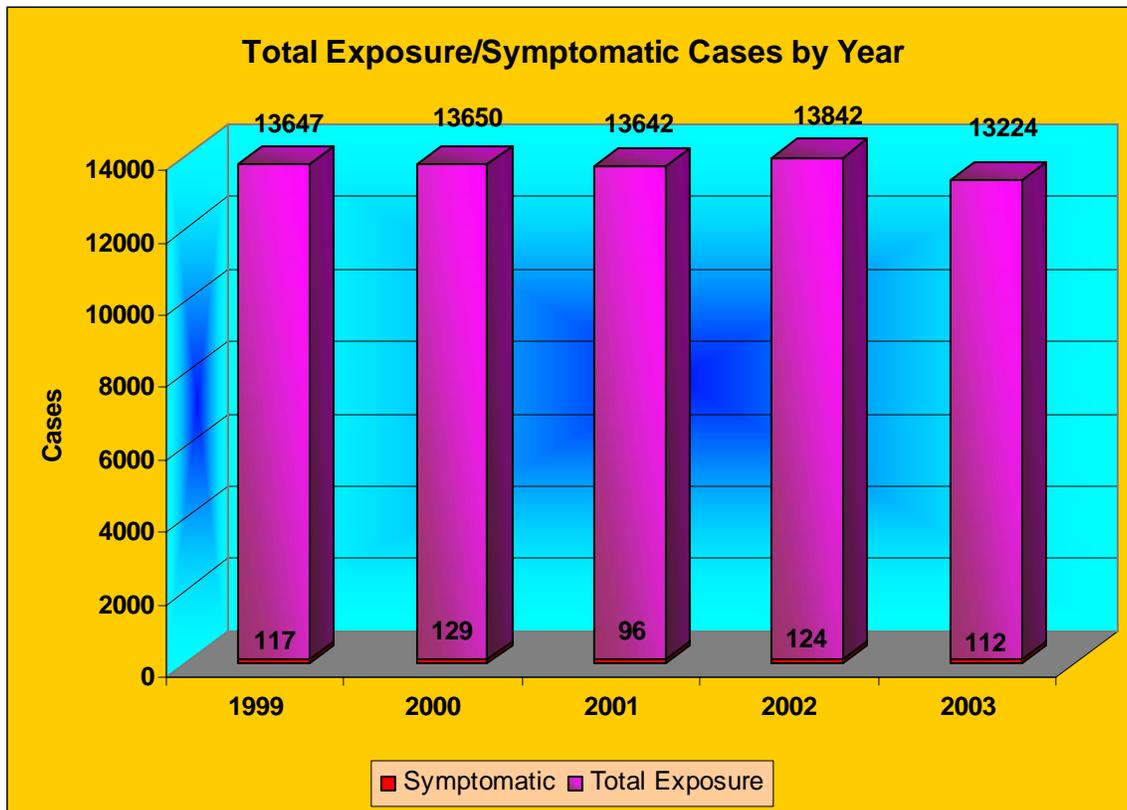
Table 2 provides additional detail by year and Figure 1 shows this same information in a graphical form. No trend is apparent for the 5 year-span for the 9-rodenticides group for the total exposure. There is no apparent trend in the cases that were symptomatic through the years; the numbers show a steady average of about 115 symptomatic cases per year.

Table 2. Number of Rodenticides Cases by Year

Year	Symptomatic Cases	Moderate Cases	Major Cases	Cases Followed	Total Exposures	HCF Cases	Hospital Cases	ICU Cases
1999	117	14	4	5845	13647	3939	62	53
2000	129	21	3	5206	13650	3643	59	44
2001	96	19	2	4845	13642	3624	63	43
2002	124	11	0	4997	13842	3551	59	42
2003	112	18	0	4656	13224	3327	59	37
Total	578	83	9	25549	68005	18084	302	219

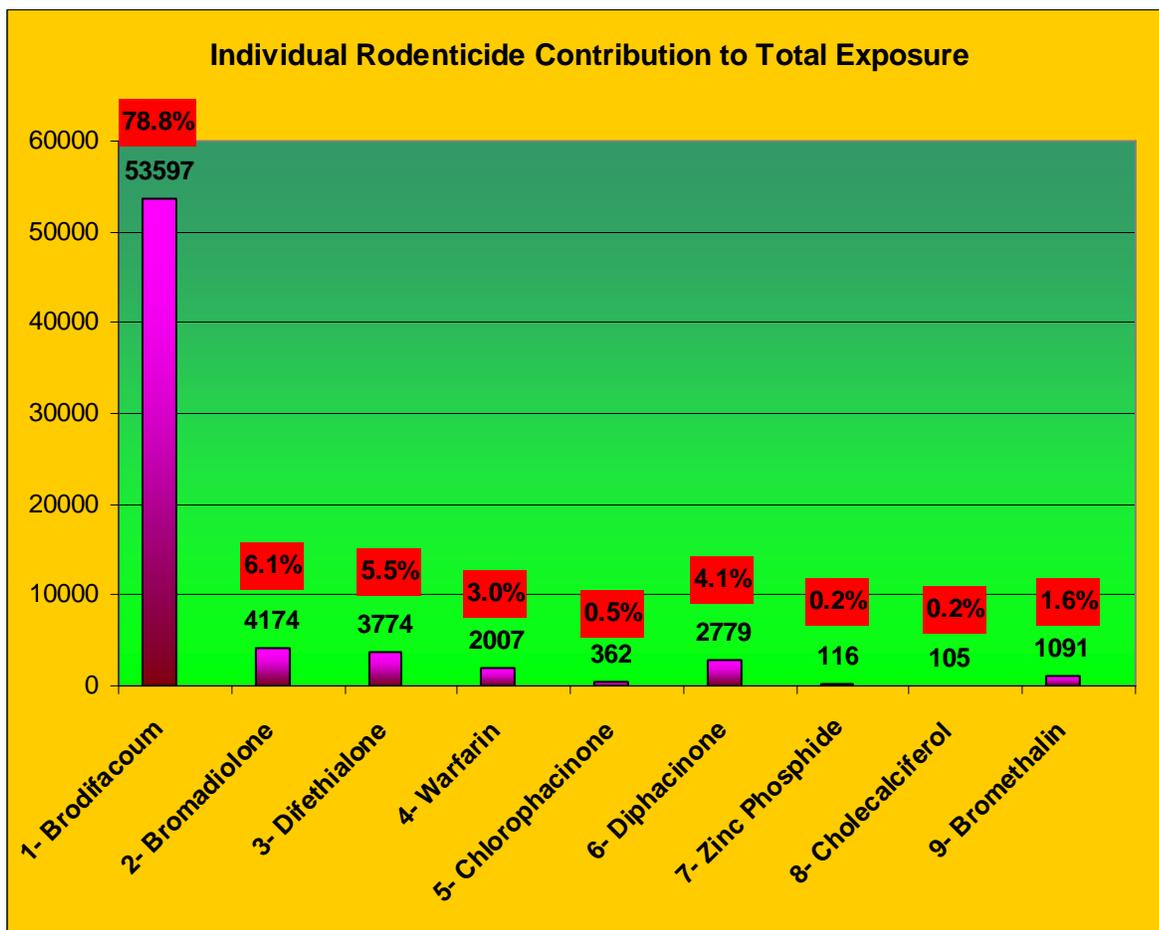
No apparent trend is noted on the 5 year-span for the 9-rodenticides group for the total exposure. However, there is a reduction of cases followed in relation to annual total exposure. This is, in 1999, 5,845 cases out of 13,367 (42.8%) were followed; at the other extreme, in 2003 only 4,656 cases out of 13,224 (35.2%) were followed. There is no apparent trend in the cases that were symptomatic through the years; the numbers show a steady average of about 115 symptomatic cases per year.

Figure 1. Total Cases and Symptomatic Cases by Year.



The relative contribution of each individual rodenticide to the total number of persons exposed to rodenticides over the 5 year period of interest is presented in Figure 2. This figure indicates that Brodifacoum contributes almost 80% of the total exposure cases of the group; the combination of Bromadiolone, Difethialone, and Diphacinone produce about 16% of the exposures. In contrast, Chlorophacinone, Zinc Phosphide, and Cholecalciferol make a combined contribution of less than 1%. The percentages are taken against the total exposure for the five-year period of 68,005.

Figure 2. Individual Contribution of Each Rodenticide to the 9-rodenticides Group.



A similar proportion is observed in relation to the number of cases that were symptomatic, as shown in Figure 3. The percentages are calculated against the total of 578 symptomatic cases. Brodifacoum contributes more than 72% of the total of symptoms, which may be a function of market share. Chlorophacinone, Zinc Phosphide, and Cholecalciferol make a combined contribution of less than 2.5%.

Figure 3. Symptomatic Cases of Rodenticides from the 9-rodenticides Group.

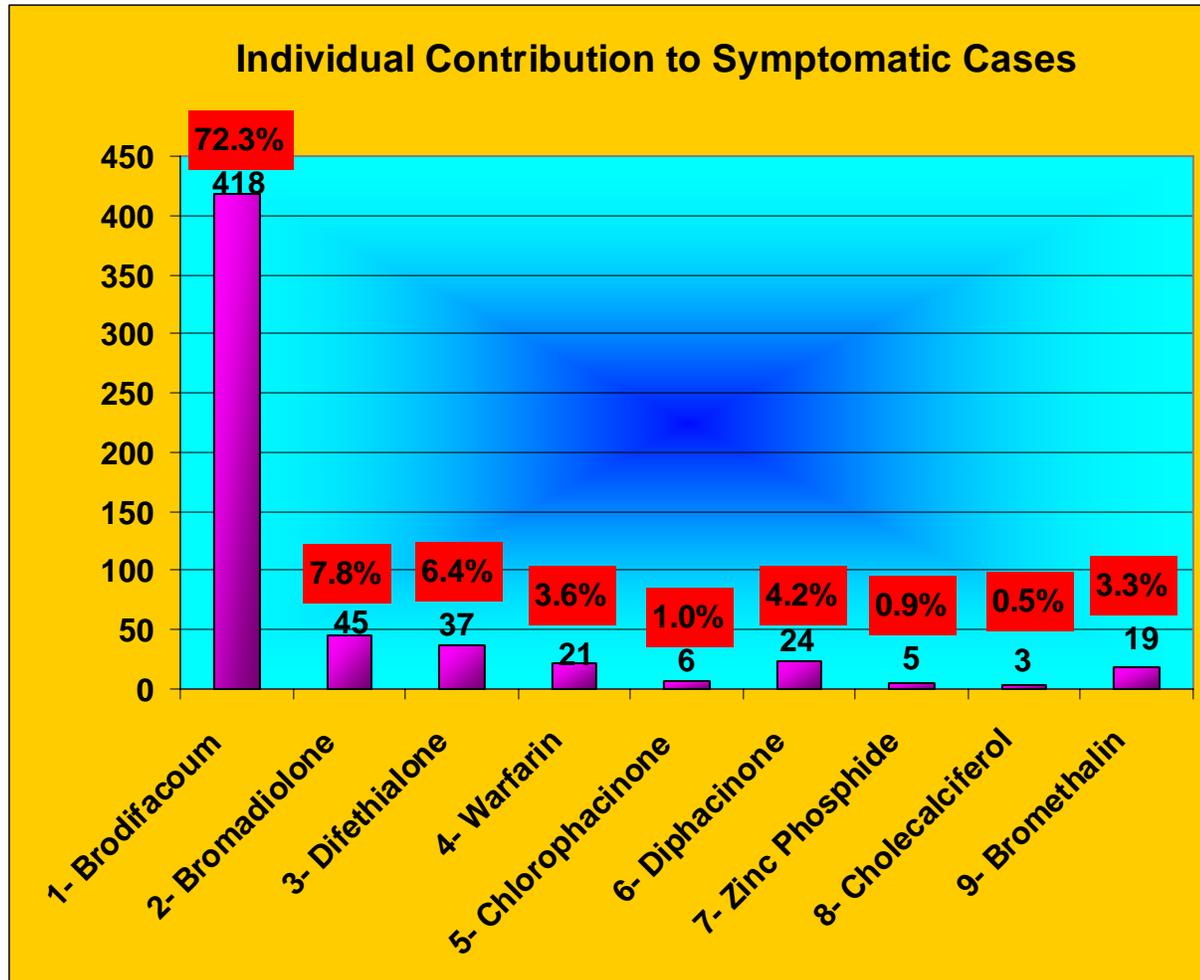
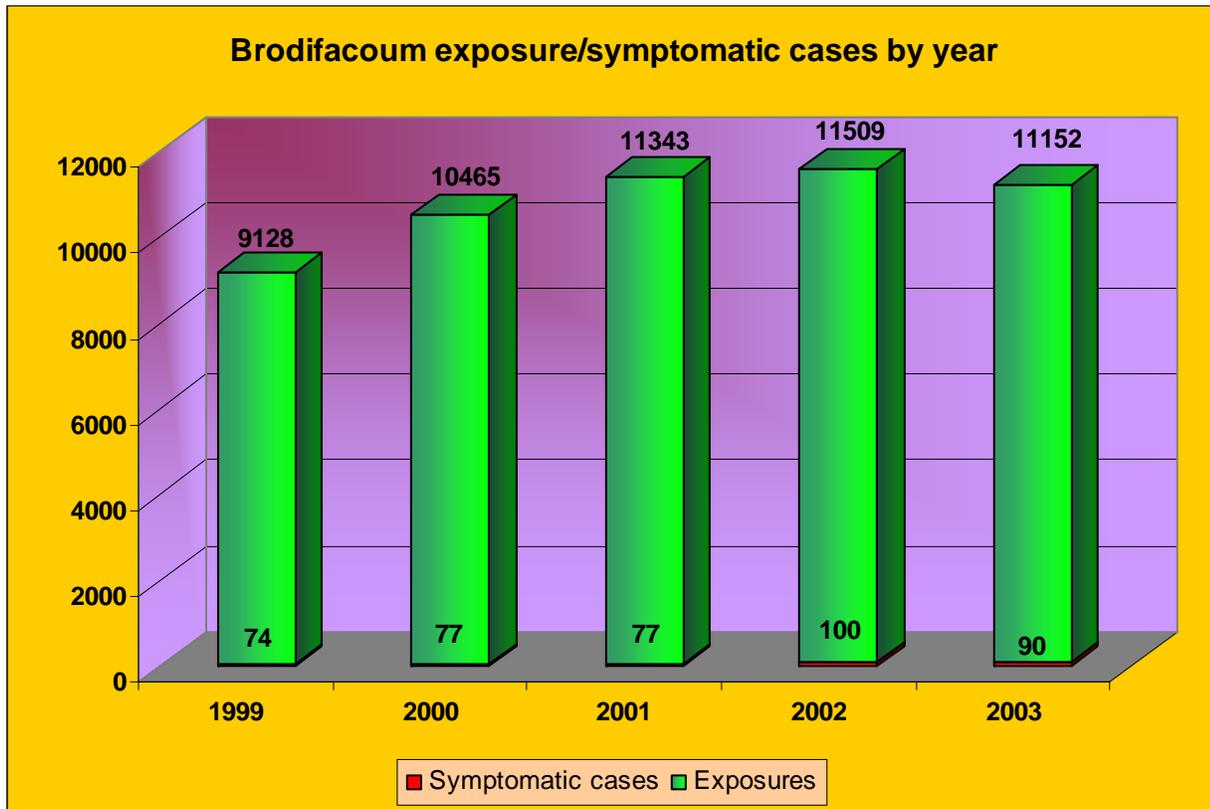


Figure 4 shows a relatively flat pattern with no decrease of exposures. There is an increase of 2,024 exposures or 22%. (from 9,128 in 1999 to 11,152 in 2003). This is equivalent to an annual average increase of exposures to Brodifacoum of 4.4%. Symptomatic cases remain relatively small proportion of total exposure.

Figure 4. Annual Distribution of Brodifacoum for Cases with Exposure and Symptoms.



Summary

According to PCC data, there are no significant changes in cases per year or proportions of rodenticides when compared to the previous report “Updated Review of Rodenticides Incident Reports Primarily Concerning Children DP Barcode D256673” dated June 3, 1999.

The summary findings for the period 1999 to 2003 for children are as follow:

- The combination of 9-rodenticides is statistically well below the composite of all pesticides in the production of symptoms, in the production of moderate symptoms and (although not statistically significant) in the production of major symptoms.

- The ratio of children seen in a Health Care Facility as a result of a potential exposure to the 9-rodenticides group is almost 70% higher than the composite of all pesticides, and statistically significant.
- The ratio of children seen in a hospital is statistically significant and lower than the composite; the fraction sent to ICU, although also lower, shows no statistical difference to the composite.
- Only 37% of exposure cases are followed.
- There is an annual reduction of cases followed of about 7% in the five-year span.
- About 1.18% of cases followed and 0.44% of the total children exposed warrant a visit to a Hospital.
- No apparent annual trend is noticed in the 5 year-span for the 9-rodenticides group.
- Brodifacoum contributes almost 80% of the total exposure cases of the group; this may be due to market share.
- Brodifacoum contributes more than 72% of the total of symptoms produce by the 9-rodenticides group.

Recommendations

Given the total number of rodenticide exposures for children under 6 years of age, risk mitigation measures to reduce exposure to this rodenticide should be considered. This could include public education and outreach, product substitution and/or use of bait stations.

Attachment 1.
**Summary of the Various Rodenticides Groups in Each Analysis
 Time Period**

Rodenticides	Superwarfarin*	Incident Memo (2006)**	Incident Memo (1999)	RED 1998***
Diphacinone	X	X	X	X
Pindoe	X		X	
Chlorophacinone	X	X	X	X
Brodifacoum	X	X	X	X
Difenacoum	X			
Bromadiolone	X	X	X	X
Bromethalin		X		X
Cholecalciferol		X		
Zinc phosphide		X	X	
Difethialone		X		
Warfarin		X	X	
Pival and sodium salt				X
Other/Unknown			X	

- *Internet source; should check how PCC defines “superwarfarin”
- ** Includes 9 subject of Comprehensive Ecological Risk Assessment
- ***Separate RED for Zinc Phosphide

Attachment 2.

Cases from the Incident Data System

Brodifacoum reports

Incident#11098-10

A pesticide incident occurred in 2000, when a girl, who is less than six years old, reported stomach pain and frequent urination. The girl's mother found some of the products pellets under their couch cushions and in one of her child's room. The mother stated that she was certain that her daughter did not ingest any of the pellets. No further information on the disposition of the case was reported.

Incident#12587-11

A pesticide incident occurred in 2002, when a fifteen month old girl reported spots that spread across her face. The girl's grandmother reported that her granddaughter ingested two or three of the product's pellets. No further information on the disposition of the case was reported.

Incident#13052-12

A pesticide incident occurred in 2002, when a fifteen month old girl grabbed the product's pellets out of the cupboard. The girl's mother took five or six pellets out of her mouth and was not sure if she swallowed any of them. The girl was taken to the emergency room and was diagnosed with a parasite. No further information on the disposition of the case was reported.

Incident#13338-15

A pesticide incident occurred in 2002, when a four year old girl reported fever, throat irritation, and drowsiness after she was found playing with the product. She was treated by a physician and the results for her mono and strep test were negative. No further information on the disposition of the case was reported.

Incident#13639-11

A pesticide incident occurred in 2002, when a two year old boy walked into a room in his house carrying the product. The boy reported blisters. He was taken to the emergency room and hooked up to a cardiac monitor for several hours. No changes in the rhythm were detected. No further information on the disposition of the case was reported.

Incident#14934-13

A pesticide incident occurred in 2004, when a one year old boy reported vomiting and diarrhea after the product's container was found ripped up behind the television and in a closet in his house. The boy's father vacuumed the floor and was not sure if his son ingested the product or not. No further information on the disposition of the case was reported.

Incident#14983-5

A pesticide incident occurred in 2004, when a five year old boy, who denies ingesting the product, was hospitalized for a week for possible ingestion of the product. His father works in a restaurant that uses the product. One day, the boy's father left him alone while he was at work and the boy could have eaten the product. The boy was released to foster care until the situation is resolved. No further information on the disposition of the case was reported.

Incident#15104-15

A pesticide incident occurred in 2004, when a two year old boy reported diarrhea, vomiting, and a fever. The boy's mother placed a few of the traps in her home. She checked the traps and noticed that $\frac{3}{4}$ of one of them was missing. The boy said that he ate some of the product. No further information on the disposition of the case was reported.

Incident#15180-5

A pesticide incident occurred in 2004, when a three year old boy, who has a history of nose bleeds, went behind a sofa to ingest the product. The boy was treated at a health care facility by a physician for a prolonged prothrombin time. No further information on the disposition of the case was reported.

Incident#15417-3

A pesticide incident occurred in 2004, when a twenty-two month old girl may have ingested the product that was placed behind a coach and in several other open areas. The girl's grandmother was not absolutely certain that she ingested the product during the previous few days. There was no evidence of the product in her mouth. The girl reported diarrhea for two days and was treated by a physician. No further information on the disposition of the case was reported.

Incident#15529-2

A pesticide incident occurred in 2004, when a nineteen month old girl reported hives and welts. The girl's mother is not absolutely certain that she ingested the product. There was no evidence of the product in her mouth but she may have been able to rinse her mouth out with the contents in her sippy cup. The girl's mother stated that she would take her daughter to the doctor. No further information on the disposition of the case was reported.

Incident#15610-2

A pesticide incident occurred in 2004, when two children licked the product. Both children were asymptomatic. A three year old boy reported a rash that was due to exposure to something else. No further information on the disposition of the case was reported.

Incident#15619-2

A pesticide incident occurred in 2004, when a one year old girl ingested less than 10 pellets of the product that were detectable in her teeth and on her tongue. The mother reported that her daughter's stool was hard and contained blood and the color of the pellets was in it. No further information on the disposition of the case was reported.

Incident#15732-4

A pesticide incident occurred in 2004, when a two year old girl reported a rash on her stomach after being at a cabin earlier in the day. Several boxes of the product were placed in the cabin. No further information on the disposition of the case was reported.

Incident#15783-10

A pesticide incident occurred in 2004, when a two year old boy reported vomiting, diarrhea, tremor, and hitting himself on the head. The boy may have picked up his pacifier off the floor. No further information on the disposition of the case was reported.

Incident#15865-1

A pesticide incident occurred in 2004, when a two year old boy may have ingested as much as one half of the product. Half of the product was missing but the pellets were not detectable in his teeth or mouth. The boy reported hives and welts all over his entire body. No further information on the disposition of the case was reported.

Incident#16032-3

A pesticide incident occurred in 2005, when a two year old boy was found with a box of the product but very little was missing. The boy reported melena. No further information on the disposition of the case was reported.

Incident#16032-6

A pesticide incident occurred in 2005, when a nine month old boy ingested an unknown amount of the product. The boy reported a rash. No further information on the disposition of the case was reported.

Incident#16136-15

A pesticide incident occurred in 2005, when a one year old boy ate one pellet of the product. The boy found it under his aunt's refrigerator and ate it before she could remove it from his hands or mouth. The boy reported a fever and a throat infection and was treated by a physician. No further information on the disposition of the case was reported.

Incident#16583-5

A pesticide incident occurred in 2005, when a six year old girl reported vomiting, edema, and a rash. The girl's parent was unsure if she ingested the entire box of the product or not but the girl denied eating the product. The girl was treated by a physician. No further information on the disposition of the case was reported.

Incident#16807-4

A pesticide incident occurred in 2005, when a two year old boy's mother found three pellets in his mouth. The boy reported blood on his behind and was treated by a physician at an emergency room. No further information on the disposition of the case was reported.

Incident#16944-6

A pesticide incident occurred in 2005, when a two year old girl played with the product and almost $\frac{3}{4}$ of it is present. The girl reported hematuria. No further information on the disposition of the case was reported.

Incident#16988-2

A pesticide incident occurred in 2005, when a fifteen month old boy found a container of the product in the kitchen with his mother present. His mother did not see the product in his mouth or in his hands. The boy reported not having a good appetite for three days and ataxia. No further information on the disposition of the case was reported.

Incident#17044-5

A pesticide incident occurred in 2005, when a two year old boy reported a small amount of blood in his stool. The boy's mother placed the product in her home. The box appeared undisturbed but she was concerned about poisoning. No further information on the disposition of the case was reported.

Incident#17230-7

A pesticide incident occurred in 2006, when a two year old girl may have ingested some of the product. The girl reported vomiting and was taken to the emergency room by her grandparent. No further information on the disposition of the case was reported.

Incident#17265-2

A pesticide incident occurred in 2006, when an eight year old boy reported difficulty breathing and lethargy. His parents placed three packets of the product out and one of the three remaining packets was left in the box. The boy's teacher sent a note home and stated that the boy fell asleep three times in her class. No further information on the disposition of the case was reported.

Incident#17464-15

A pesticide incident occurred in 2006, when a boy, who is less than six years old, was taken to the emergency room by his grandparent after possibly ingesting the product. The boy reported edema and blood was dripping from his nose and ears. No further information on the disposition of the case was reported.

Incident#17510-4

A pesticide incident occurred in 2006, when a two year old girl was found with an open product. The product was not detected in her mouth or on her hands. A small amount was missing from the product. The girl's mother gave her something to drink. The girl passed black stool and blood was found around her anal area. No further information on the disposition of the case was reported.

Incident#17221-1

A pesticide incident occurred in 2006, when a two year old girl was found by her uncle with the product in her hands and the product was wet. The girl reported melena and was being taken to the hospital. No further information on the disposition of the case was reported.

Incident#17226-14

A pesticide incident occurred in 2006, when a nine year old boy's father had an empty pail from the product that he was storing bolts in. There is some residue in the pails. The boy's

father wasn't sure if his son touched the bolts and the product was absorbed through the skin or not. The boy reported diarrhea for three to four days. No further information on the disposition of the case was reported.

Bromadiolone reports

Incident#12563-1

A pesticide incident occurred in 2000, when a two year old girl reported vomiting. The product was discovered open and under the bathroom sink by her parent. The girl may have ingested the product. No further information on the disposition of the case was reported.

Incident#12690-1

A pesticide incident occurred in 2002, when a sixteen month old girl reported hematuria and was treated by a physician. The girl may have ingested the product but her symptoms may be due to living in an extremely unsanitary home. No further information on the disposition of the case was reported.

Incident#13542-1

A pesticide incident occurred in 2002, when a fifteen month old girl reported vomiting that contained blood, discolored stool, and diarrhea. The girl was treated by a physician at an emergency room. No further information on the disposition of the case was reported.

Incident#15242-1

A pesticide incident occurred in 2004, when a five year old boy reported a prolonged prothrombin time and was treated by a physician. The boy was playing with the product at a neighbor's house. Some of the pellets were found in his mouth. No further information on the disposition of the case was reported.

Incident#15508-2

A pesticide incident occurred in 2004, when a two year old boy reported discolored stool (bright green like the product) and a fever. His mother placed two one-ounce blocks of the product in her home that disappeared. No further information on the disposition of the case was reported.

Incident#15644-1

A pesticide incident occurred in 2004, when a twenty month old boy reported a fever and chills. The boy's mother caught him and his dog playing with one bait block. The dog ate about ¼ of the 28 gram block and the boy may have been chewing on it. The boy was treated by a physician and diagnosed with a viral illness. No further information on the disposition of the case was reported.

Incident#16204-1

A pesticide incident occurred in 2005, when a two year old boy reported a fever and hallucination. His father thinks he may have ingested the product. No further information on the disposition of the case was reported.

Difethialone reports

Incident#16807-20
Missing Incident.

Warfarin reports

There were no incident reports involving children exposed to warfarin in the Incident Data System.

Chlorophacinone reports

There were no incident reports involving children exposed to chlorophacinone in the Incident Data System.

Diphacinone reports

Incident#11808-1

A pesticide incident occurred in 2001, when a nineteen month old girl was taken to the emergency room after it was not certain whether she ingested the product or not. The girl's coagulation study was normal so the attending physician did not administer any type of treatment. No further information on the disposition of the case was reported.

Incident#16363-1

A pesticide incident occurred in 2005, when a thirteen month old girl tasted one pellet of the product as witnessed by her father. The girl reported a rash over her entire body and swollen eyes. No further information on the disposition of the case was reported.

Incident#17324-1

A pesticide incident occurred in 2006, when a one year old girl ingested one pellet of the product as witnessed by her mother. The girl reported vomiting for a few days. No further information on the disposition of the case was reported.

Zinc Phosphide reports

Incident#17470-1

A pesticide incident occurred in 2006, when a seven year old boy and his brother swept their shed with the product that spread across the floor. The boy reported abdominal pain, conjunctivitis, and shortness of breath. The boy was treated by a physician. No further information on the disposition of the case was reported.

Cholecalciferol reports

There were no incident reports involving children exposed to cholecalciferol in the Incident Data System.

Bromethalin reports

Incident#11593-10

A pesticide incident occurred in 2001, when a fourteen month old boy ingested the product. The boy reported agitation, irritability, and vomiting and was treated by a physician at an emergency room. No further information on the disposition of the case was reported.

Incident#13273-1

A pesticide incident occurred in 2002, when an eighteen month old girl's mother was not watching her daughter while she cleaned her house. Her mother was not sure if she ingested some of the product that she had placed behind her couch. She gave her daughter some milk and she vomited and also reported a fever. The girl was treated by a physician for a virus. No further information on the disposition of the case was reported.

Attachment 3. Table Description

Table 1.

	Severity of outcome (outcome determined)			Total exposed	Health care provided	
Denominator numbers	25,549			68,005	18,084	
Measures	SYM	MOD	MAJ	HCF	HOSP	ICU
Numerator numbers	578	83	9	18,084	302	219
9 Rodenticides percents	2.26%	0.32%	0.03%	26.59%	1.67%	1.21%
All Pesticides percents	21.72%	1.42%	0.12%	15.68%	4.34%	1.75%
Ratio of 9 Rodenticides /All pesticides	0.10(S) P = 0.00	0.23 (S) P = 0.00	0.25 P = 0.94*	1.69 (S) P = 0.00	0.38 (S) P = 0.00	0.69 P = 0.51

The following is a brief description of the table components:

- A) The first row “Denominator numbers” presents all the numbers that will serve as denominators in the calculation of the percents, and they are:
- In the center column, total amount of individuals exposed to group of 9 rodenticides (n = 68,005) Total Exposed.
 - In the left, amount of cases followed, (n = 25,546) these cases have an outcome determined (Outcome determined)
 - At the right of the table, cases that visited a Health Care Facility (n = 18084) Health care provided
- B) The row “Measures” describes the outcomes for the cases: SYM cases that were symptomatic; MOD cases that were classified as moderate; MAJ cases that were classified as major or fatal; HCF cases of exposure that went to a Health Care Facility; HOSP cases that went to a hospital; and ICU cases that went to an Intensive Care Unit.
- C) The row “Numerator numbers” are actually the number of cases that presented the outcome describe in the Measures row.
- D) The row “9 Rodenticides percents” gives the percentages on each measure. These percentages are calculated by dividing the numerator number by the denominator number (from each major section of the Table 1) and multiplying by 100. For example 578, 83, and 9 are divided by 25,549 producing the respective percents 2.26, 0.32, and 0.03, for SYM, MOD, and MAJ. In a similar fashion 18,084 is divided by 68,005 for the

percentage of cases seen in a HCF of 26.59; and for the last section of the Table 1, 302 and 219 are divided by 18,084 to find the percentages of cases that went to a hospital and ICU.

- E) The row “All Pesticides Percents” are percentages that were calculated using all cases available in the PCC database. These percentages serve as the baseline for the comparison with the given pesticide, or grouping, in this case a group of 9 rodenticides.
- F) The “Ratio of 9 Rodenticides/All pesticides” row is obtained by dividing the percentages of the given compound by the “all pesticides” percentages, to obtain a dimensionless number or ratio. This ratio provides an idea of the relative importance of the given compound (in this case a group of nine). For example, a ratio of 1 (one) indicates that the percentages are the same for the compound (or group) under study and the composite of all pesticides; a ratio, say of 2 (two) indicates that the chemical under study (in this case the average of 9 rodenticides) produces twice the effect; and a ratio of 0.5 indicates that the compound has half of the activity of the “composite.” The advantage of these ratios is that they provide a quick overview of the relative importance of the chemical or grouping.
- G) Also, the “p” value that results from a Likelihood ratio test is entered in the ratio cell and when significant ($p < 0.05$) then an **(S)** is entered next to the ratio to mark statistical significance. A cell marked with **(S)** means that the percentages that produce the ratios are “statistically” significant and not due to chance. The percentage of the given compound could be higher or lower than the percentage produce by the composite as indicated by the ratio. For example, a ratio = 1.6 **(S)** means the effect produced by the compound is higher than the effect produced by the composite and statistically different; a ratio = 0.7 **(S)** signifies that the chemical has a lower effect than the composite and is statistically different. On the other hand, a ratio = 1.2, with no **(S)**, means that the percentage, although higher, is not statistically different from the composite.